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ROLE OF NON-FERROUS METALS AND ALLOYS IN RAILWAY ENGINEERING (*)

K.C. Choudhuri,
Director (M & C),
Research Design & Standards Orgn., Lucknow.

In the Railways, non-ferrous metals and their alloys are mostly used in the manufacture of castings due to ease in production. In addition to resistance to corrosion and wear, some type of castings such as boiler mountings have to meet pressure tightness. The castings used in Railway Engineering can be broadly classified in the following groups:-

i) Phosphor bronze is used for manufacture of heavily loaded details which are subjected to friction where anti-friction metal is not employed such as locomotive slide valves, oil lubricated side rod and motion brushes, steel axle box side and boss linears, pony pivot bushes, bogie centre plates, oil lubricated connecting rod, small end bushes, etc.

ii) Gun metal castings are used for boiler mountings and steam and water pressure fittings, such as injector starting valve body, fusible plugs, relief valves, drifting valve body, whistle valve body, steam stand stuffing box, etc., etc., where resistance to corrosion and high steam pressure tightness are of primary importance.

iii) Two types of leaded bronze castings are used; one with higher lead content 14-16% and the other with 9-11%. These castings are mainly used for the manufacture of grease lubricated non-ferrous axle boxes, carriages and wagon bearing shells, grease lubricated side rod motion bushes, grease lubricated connecting rod bearings, etc., where bearing properties are of prime importance.

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iv) Leaded gun metal castings are also used for the manufacture of carriage and wagon bearing shells which require fair strength, soundness and good machining properties in addition to bearing properties.

v) Antifriction metals of both tin base and lead base are in use on the Railways for lining of such components which are subjected to friction in service such as axle boxes of locomotives, carriage and wagon bearing shells, cross-head of locomotives, etc.

vi) Aluminium bronze castings are in use on the Indian Railways for over head fittings of electric traction whose strength combined with high resistance to corrosion are of great importance.

Lately, high conductivity copper wires and sheets are being used for the manufacture of traction motors for electric locomotive in the Chittaranjan Locomotive Works. This is the new specialised field in which Railways have gone in.

The scrap arisings of non-ferrous metals are substantial in Railways. In addition to the conventional method of reclamation of these by melting with other alloy additions wherever necessary and possible, methods for separation of whitemetal and bronze from the mixed borings and reclamation of lead from lead battery scrap have been evolved and adopted. These steps have helped considerably in cutting down consumption of virgin non-ferrous metal resulting in large savings in foreign exchange.

Efforts for finding Substitutes.

Bauxite occurs abundantly in India and the applications and potentiality of aluminium as a substitute metal have been examined by the National Metallurgical Laboratory and have shown great promise. The Railways are trying to attain self-sufficiency by substitution of imported non-ferrous metals with indigenously available ones and as such considerable work has been done in the Railways and the Railway Research Laboratories. Some of the important items in which work has been done or has been planned for finding out indigenous substitutes are as follows:-

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1. Substitution of conventional bronze bearing shells by SGCI for Carriage and Wagons.

2. Substitution of gun metal boiler mountings of steam locomotives by SGCI boiler mountings.

3. Substitution of solid bronze axle boxes by steel boxes with bronze bearing insert/roller bearing.

4. Substitution of solid bronze bearing and bushes by aluminium base bearing alloys.

   -This problem was referred to National Metallurgical Laboratory, Jamshedpur and they have recently developed an aluminium base alloy and have prepared a few floating bushes for YL class locomotives for trial purposes.

5. Substitution of copper cables by insulated aluminium cables for train lighting and signalling.

6. Substitution of copper overhead electric transmission line by aluminium for distribution of power to town supply.

7. Substitution of Galvanising by Aluminising.

8. Substitution of lead by PVC for sheathing of power cables.

9. Development of contact springs based on indigenously available materials for use in signal equipment.

   - Phosphor bronze contact springs are used in electro-mechanical and power signalling equipment. This material has, however, to be imported. The problem of development of contact springs based on indigenously available material was farmed out to the National Metallurgical Laboratory, Jamshedpur. They have been able to develop the technique of production of phosphor bronze springs and tests on samples supplied by the National Metallurgical Laboratory have been completed by R.D.S.O., Lucknow. Results in the case of one of the samples are encouraging.

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10. Development of electrical contacts based on indigenous materials used for signal relays.

Imported electrical contacts are used in various circuit controls and signal relays. Silver diffused carbon contacts are usually used for this purpose. Requirements of the nonfusible type of silver carbon contacts for signalling relays is nearly Rs. 2 lakhs per annum. Metal to metal contacts have also been used in some cases in imported equipment but their reliability against fusion is still not free from doubt. Work on the development of silver carbon contacts is being carried out by the National Physical Laboratory, New Delhi.

Non-ferrous metals and their alloys play an important part in Railway Engineering due to special service requirements. Therefore, entire substitution of valuable non-ferrous metal is neither possible nor feasible. However, continued efforts have have to be made to substitute the imported non-ferrous metals with the indigenously available metals wherever possible.

The railway engineers have already realised that if industrialisation is to be quickened in India and if shortages of copper, zinc, lead, tin, etc., cannot be met during the Fourth Plan period, there is no choice but to welcome increased use of aluminium in various spheres of railway engineering as aluminium is an indigenous material in which our country is expected to be self-sufficient in the near future.

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